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## BILL HANDLING MACHINE

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## BACKGROUND OF THE INVENTION

The present invention relates to a bill handling machine, and in particular, to a bill handling machine in which a bill storing box is attachable and detachable in the bill handling machine in operation.

For example, JP-A-11-175801 describes a conventional bill handling machine including a money receiving/paying port, a transport path, a money separating section, a temporary storing box, and money storing box. The money storing box of the bill handling machine includes a money receiving box, a money paying box, a recycle box, a charge/recovery box, and the like. The money storing box can be attached onto and detached from the bill handling machine.

## 15 SUMMARY OF THE INVENTION

In the conventional bill handling machine, when a money or bill storing box is attached onto the bill handling machine, for example, after a bill storing box used up to this point of time is detached therefrom, it is impossible for the bill handling machine to obtain information of the number of bills existing in the bill storing box thus attached onto the machine. Therefore, even if the bill storing box is full of bills installed by an operator, an operation to

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deposit money may possibly be conducted after the bill  
handling machine resumes its operation. In this  
situation, the machine tries to store the received  
bills in the bill storing box. This consequently may  
5 lead to an abnormal state depending on cases. On the  
other hand, even if the bill storing box is empty after  
an operator removes the bills therefrom, an operation  
to draw money may possibly be conducted after the bill  
handling machine resumes its operation. In this  
10 situation, the machine tries to obtain bills from the  
empty bill storing box. This possibly causes an  
abnormal state in some cases.

Additionally, when the bill storing box is  
installed on the bill handling machine as above, the  
15 machine cannot obtain information of a type of bills  
such as a 10000-Yen bill or a 1000-Yen bill and  
information of a type of the bill storing box such as a  
money receiving box, a money paying box, or a recycle  
box. Therefore, when the bill storing box is filled  
20 with bills of a type not expected by the bill handling  
machine, the machine possibly tries to obtain therefrom  
or to store therein bills of an unexpected type, which  
leads to an abnormal state in some cases. There may  
also occur a case in which the bill handling machine  
25 tries to store bills in a bill paying box or to obtain  
bills from a bill storing box, which also causes an  
abnormal state depending on cases.

It is therefore an object of the present

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5 operator.

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## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more apparent

from the following detailed description, when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic diagram showing an embodiment of a bill handling machine according to the present invention;

Fig. 2 is a diagram showing control blocks of the bill handling machine;

Fig. 3 is a flowchart showing operation of a main control section to obtain the number of remaining bills;

Fig. 4 is a flowchart showing operation of a main control section to obtain the number of remaining bills;

Fig. 5 is a flowchart showing operation of a main control section to obtain the number of remaining bills;

Figs. 6A to 6C are diagrams showing operation of a pushing plate in an operation to obtain the number of remaining bills;

Fig. 6D is a graph for explaining an output from a pushing plate position sensor and a counting operation of a pushing plate position counter;

Fig. 7 is a flowchart showing operation of a main control section to recognize a bill storing box installed in a bill handling machine;

Fig. 8 is a flowchart showing operation of a main control section to store identifier information in a storing box identifier information storage;

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Fig. 9 is a flowchart showing operation of a main control section to store identifier information in a storing box identifier information storage; and

Fig. 10 is a flowchart showing operation of a main control section to control a balance of amount in the bill handling machine.

#### DESCRIPTION OF THE EMBODIMENTS

Referring now to Figs. 1 to 10, description will be given of embodiments of the present invention.

10 Fig. 1 shows a bill handling machine according to the present invention. Fig. 2 shows control blocks of the bill handling machine. These diagrams includes a bill or money receiving/paying section 1, a bill transport path 2 to transport bills  
15 to respective sections of the bill handling machine, a bill judge section 3 to make decision for truth or falsehood as well as a kind of each bill, to determine a bill appropriate for the payment, and to determine a bill as a rejected bill not suitable for the payment; a  
20 temporary bill storing box of winding type 4, a bill storing box 5, and a pushing plate 6 arranged in the bill storing box 5 to be driven by, for example, a motor to depress bills or to release the depressed state thereof. The pushing plate 6 includes a pushing  
25 plate position counter to detect a position of the plate 6 so that the position (the number of bills in the depressed state) is detected according to a count

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value of the counter.

The configuration of Figs. 1 and 2 also includes a passage sensor 7 disposed in a transport path of bills to detect passage of a bill, a gate 8 to change a transport direction of a bill, a rejected bill storing box 9 to store a bill rejected by the judge section 3, a housing or cabinet 10 of the bill handling machine, an installing section 10a formed in the housing 10 to install a bill storing box, a door 11 of the cabinet 10, an open/close sensor 12 to detect opened and closed states of the door 11, a storing box position sensor 13 to detect whether or not the box is at an installation position, a pressure sensor 14, an empty state sensor 15 to detect an empty state of a storing box in which the storing box is empty, and pushing plate sensors 16 and 17 to detect the pushing plate to adjust a pushing position counter, which will be described later. The sensor 17 detects the pushing plate at a position at which the storing box is full of bills, and the sensor 16 detects the pushing plate at a position at which the bill storing box contains few bills. The pushing plate position counter detects the position of the pushing plate 6 and detects the number of bills in the bill storing box according to the detected position. The configuration further includes a shutter 18 disposed at an entrance of the money receiving/paying section 1, a money receiving/paying section pushing plate 19 which pushes the bills to hold

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the bills for reception or payment, and a panel key 20 for the operator to use when the bill handling machine is to be operated as a single unit. The system also includes a counter 21 to display an operation state of the panel key 20.

The configuration of Figs. 1 and 2 further includes a higher-level unit 101 of the bill handling machine, a higher-level line connecting section 102 to establish connection to the higher-level unit 101, a motor controller 103 to drive the transport path, and a transport path position counter 104 to obtain an amount of shift of the transport path. The system also includes a sensor controller 105 to control sensors such a passage sensor to detect passage of a bill and a door open/close sensor to detect the opened and closed state of the door, a gate controller 106 to change the gate 8 according to a sense signal from the passage sensor 7 and the amount of shift of transport passage from the transport path position counter 104. The configuration further includes a money receiving/paying section controller 107 to control the money receiving/paying section 1, a temporary storing box controller 108 to control the temporary storing box 4, a pushing plate driving motor controller 109 to drive the pushing plate 6, a pushing plate shift amount counter 110 to obtain an amount of shift of the pushing plate 6, a main controller 111 to control respective sections of the bill handling machine, a main storage

112, a bill judge section controller 114 to control the  
bill judge section 3, and a bill judge section line  
controller 113 to establish connection to the bill  
judge section controller 114. The system of Figs. 1  
5 and 2 also includes a storing box storage 116 attached  
to a storing box to store information to identify the  
storing box and a storing box line controller 115 to  
establish connection to the storing box storage 116.

When the bill handling machine is used in a  
10 money depositing operation, the user installs bills in  
the money receiving/paying section 1. The section 1  
feeds the bills in a bill-by-bill fashion to the  
transport path. The bill judge section 3 makes a judge  
for truth or falsehood and determines a type of bill of  
15 each bill. The section 3 then determines that the bill  
is appropriate for the payment or that the bill is not  
appropriate for the payment (a rejected bill) to select  
a storing destination of the bill. The rejected bill  
regarded as unacceptable by the bill judge section 3 is  
20 returned to the money receiving/paying section 1 so  
that the user receives the rejected bill out of the  
section 1. The bill regarded as acceptable by the bill  
judge section 3 is wound in the temporary storing box 4  
to be temporarily stored therein. Thereafter, the  
25 pushing plate 6 of the storing box 5 is driven to  
reserve a space to store bills. The temporary storing  
box 4 is reversely driven to feed the bill to the  
transport path 2 to transport the bill. The

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transported bill is monitored by the passage sensors 7  
over the passage path 2, and the gates 8 are changed  
according to the storing destination of the bill. That  
is, while the bill regarded as acceptable by the bill  
5 judge section 3 is stored in the storing box 5, the  
bill regarded as rejected by the bill judge section 3  
is stored in the rejected bill storing box 9.

After the money depositing operation is  
repeatedly conducted, when the storing box 5 becomes  
10 full of bills, the operator opens the door 11 of the  
cabinet 10 of the bill handling machine and removes the  
storing box 5 from the installing section 10a to  
collect the bills. The operator installs the storing  
box 5, which is empty or which contains some bills, in  
15 the installing section 10a of the cabinet 10, closes  
the door 11, and resumes the operation.

In an operation to withdraw money, the bill  
handling machine obtains a bill from a storing box of  
bills of a specified type and feeds the bill in a bill-  
20 by-bill fashion to the transport path 2. The bill  
judge section 3 makes a judge for a type of bill and  
for truth or falsehood of the bill. While the rejected  
bill regarded as unacceptable by the bill judge section  
3 is temporarily stored in the temporary storing box 4,  
25 only the bills regarded as acceptable is transported to  
the money receiving/paying section 1. Thereafter, the  
rejected bill is fed from the temporary storing box 4  
to the rejected bill storing box 9.

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Also in step 205, the main controller 111 determines using the storing box position sensor 13 whether or not the storing box 5 is at other than the fixed position. If the storing box 5 is at the fixed position, control goes to step 206; otherwise, control goes to step 207. In step 206, a state that the storing box 5 has been returned to the installation position, that is, the storing box 5 has been re-installed is stored in the main storage 112. In step 10 207, the main controller 111 determines whether or not a condition "the door 11 is closed" has been detected. If this is the case, control proceeds to step 208; otherwise, control proceeds to step 202. In step 208, the main controller 111 makes a retrieval through the 15 main storage 112 to determine presence or absence of a record of "the storing box 5 has been re-installed". If the record is present, control goes to step 209 of Fig. 4; otherwise, control goes to step 230. In step 230, the main controller 111 makes a retrieval through 20 the main storage 112 to determine presence or absence of a record of "other than the fixed position". If the record is present, control goes to step 231; otherwise, the processing is terminated. In step 231, the main controller 111 reports the state "the storing box 5 has 25 not been installed yet" to the higher-level unit 101. The unit 101 displays the condition "the storing box 5 has not been installed yet" to notify the operator the condition for confirmation.

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In step 209 of Fig. 4, the main controller 111 controls the pushing plate driving motor to move the pushing plate 6, for example, at a position (④) of Fig. 6 in the forward direction and makes a check to  
5 determine whether or not pressure has been sensed (step 210). If the pressure sensor 14 has sensed the pressure, control goes to step 213; otherwise, control goes to step 211. In step 211, the main controller 111 determines whether or not a pushing plate sensor 17 or  
10 16 placed at the full position (B) or the few-fill position (A) has sensed the pushing plate 6. If the pushing plate 6 has been sensed, control goes to step 212; otherwise, control goes to step 210. In step 212, the main controller 111 sets the count value of the  
15 pushing plate position counter to the count value at the full position (B) or the few-fill position (A).

In step 213, the main controller 111 stops the forward movement of the pushing plate 6, delays the operation of the pushing plate 6 for a predetermined  
20 period of time (step 214), and then starts the reverse movement of the pushing plate 6 (step 215). The main controller 111 determines whether or not a pushing plate sensor 14 has sensed the depressed state release condition "release depressed state" (step 216). If the  
25 condition has been sensed, control goes to step 219; otherwise, control goes to step 217. In step 217, the main controller 111 determines whether or not the pushing plate sensor placed at the full position (B) or

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6. If the pushing plate 6 has been sensed, control goes to step 218; otherwise, control goes to step 216.

5 value of the pushing plate position counter to the

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10  controller 111 determines whether or not the empty

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sensor 15 has sensed a state that the storing box 5 is empty. If the empty state is sensed, control goes to

the empty state is detected, the main controller 111

In step 222, the main controller 111 determines whether or not the count value of the pushing plate position counter has been corrected. If the value has been corrected, control goes to step 223; otherwise, control

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    sets the number of remaining bills to the count value

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determines whether or not the pushing plate sensor 16 placed at the few-bill position (A) produces an output

25 at a high (H) level and the pushing plate sensor 17  
placed at the full position (B) produces an output at a  
low (L) level. If the check results in "truth",

control goes to step 225; otherwise, control goes to

step 226. In step 225, the main controller 111 sets the number of remaining bills to a number of bills A corresponding to the few-bill position (A).

In step 226, the main controller 111  
5 determines whether or not the pushing plate sensor placed at the few-bill position (A) produces an output at a low (L) level and the pushing plate sensor placed at the full position (B) produces an output at a high (H) level. If the check results in "truth", control  
10 goes to step 227; otherwise, control goes to step 228. In step 227, the main controller 111 sets the number of remaining bills to a number of bills A corresponding to the full position (B).

On the other hand, in step 228, the main  
15 controller 111 temporarily calculates the number of remaining bills as  $(A + B)/2$ . That is, since the counter is not corrected in these cases, the number of remaining bills is provisionally set as  $(A + B)/2$ . In step 229, the main controller 111 sends to the higher-  
20 level unit 101 a report of the state of remaining bills such as the number of bills counted or calculated, the empty state, the few-bill state, or the full state. According to the state of remaining bills, the higher-level unit 101 displays the state for the confirmation  
25 of the operator and/or to control the user at the bill handling machine or the bill handling operation for the storing box.

As above, to check the number of remaining

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bills in the storing box 5, the pushing plate 6 is moved in a forward direction (the number of remaining bills lowers in this direction) or in a reverse direction (the number of remaining bills increases in this direction) after it is confirmed that the storing box 5 is installed in the bill handling machine. Therefore, the amount or the number of remaining bills can be, although roughly, recognized.

Fig. 7 shows a flow of processing of the main controller 111 to recognize the storing box 5 re-installed in the bill handling machine. In step 301, after the bill handling machine is activated, the main controller 111 controls the storing box line controller 115 to acquire storing box identifier information stored in the storing box storage 116 such as information of a type of the storing box, namely, a money receiving box, a money paying box, or a recycle box and information of a bill type, namely, a 10000-yen bill, a 1000-yen bill, or a US-dollar bill. In step 302, the main controller 111 stores the obtained storing box identifier information in the main storage 112. In step 303, the door 11 is monitored whether or not the door is opened. When it has been detected that the door 11 is opened, control goes to step 304. In step 304, the main controller 111 makes a retrieval through the main storage 112 to determine whether or not the state "the storing box is at other than the fixed position" has been stored. If the state has been

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not stored, control goes to step 305; otherwise,  
control goes to step 307. In step 305, the main  
controller 111 determines whether or not the storing  
box is at other than the installed position, namely, at  
5 other than the fixed position. If the storing box is  
other than the fixed position, control goes to step  
306; otherwise, control goes to step 309. In step 306,  
the main controller 111 stores the state "the storing  
box is other than the fixed position" in the main  
10 storage 112. In step 307, the main controller 111  
determines whether or not the storing box is at the  
installed position, namely, at the fixed position. If  
the storing box is at the fixed position, control goes  
to step 308; otherwise, control goes to step 309. In  
15 step 308, the main controller 111 determines whether or  
not a state "the door has been closed" has been sensed.  
If the state has been sensed, control goes to step 310;  
otherwise, control goes to step 304.

In step 310, the main controller 111 makes a  
20 retrieval through the main storage 112 to determine  
whether or not a record "storing box re-installed" is  
present therein. If the record is present, control  
goes to step 311; otherwise, the processing is  
terminated. In step 311, the main controller 111  
25 controls the storing box line controller 115 to acquire  
storing box identifier information stored in the  
storing box storage 116. In step 312, the main  
controller 111 determines if the obtained storing box

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identifier information before the re-installation of the storing box differs from that thereafter. If the information before the re-installation varies from that after the re-installation, control goes to step 313; otherwise, the processing is terminated. In step 313, the main controller 111 stores the updated storing box identifier information in the main storage 112. In step 314, the main controller 111 sends the updated storing box identifier information to the higher-level unit 101. The unit 101 displays the configuration of the installed storing box for the operator to confirm that the correct storing box has been installed.

Figs. 8 and 9 show a processing flow of the main controller 11 to store the storing box identifier information in the storing box identifier information storage.

In step 401, the main controller 111 waits for a state that A key of the panel-key unit 20 is set to on. When A key is set to on, control goes to step 402. In step 402, whether or not G key has been depressed. If G key has been depressed, control goes to step 403; otherwise control goes to step 404. In step 403, for example, "1" is added to a count value X in a part of higher positions of the counter 21. In step 404, whether or not H key has been depressed is determined. If H key has been depressed, control goes to step 405; otherwise control goes to step 406. In step 405, for example, "1" is added to a count value X

in a part of lower positions of the counter 21. In  
step 406, whether or not C key has been depressed is  
determined. If C key has been depressed, control goes  
to step 410 of Fig. 9; otherwise control goes to step  
5 407. In step 407, whether or not A key is set to off  
is determined. If A key is set to off, the processing  
is terminated; otherwise, control goes to step 402.

In step 410 of Fig. 9, the main controller  
111 determines whether or not the system is in a mode  
10 to set storing box identifier information. If the  
system is in the mode, control goes to step 413;  
otherwise, control goes to step 411. In step 411, the  
main controller 111 determines whether or not, a  
condition, for example,  $X = 3$  and  $Y = 1$  is already set.  
15 If this condition is set, control goes to step 412;  
otherwise, control goes to step 412.

In step 412, the system enters the storing  
box identifier information setting mode. In step 413,  
the main controller 111 determines whether or not, for  
20 example, a storing box number of the storing box as an  
object of operation to store the storing box identifier  
information has already been set. If the storing box  
number has been set, control goes to step 415;  
otherwise, control goes to step 414. In step 414, the  
25 main controller 111 sets the objective storing box  
number (i.e., the storing box number inputted by using  
G and H keys of the panel-key unit 20 is set to the  
main controller).

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In step 415, the main controller 111 determines whether or not information of a type of the storing box is already set. If the type information is set, control goes to step 418; otherwise, control goes to step 416. In step 416, the main controller 111 instructs the storing box line controller 115 to store type information, e.g., a code of "02" indicating, for example, that the storing box is a bill receiving box. In step 417, the main controller 111 sets the type information (i.e., the type information inputted by using G and H keys of the panel-key unit 20 is set).

In step 418, whether or not information of a bill type of the storing box is already set is determined. If the bill type is determined, control goes to step 407; otherwise, control goes to step 419. In step 419, the main controller 111 instructs the storing box line controller 115 to store bill type information, e.g., a code of "10" indicating, for example, that the bill type of the storing box is "1000-yen bill". In step 420, the main controller 111 sets the bill type information (i.e., the bill type information inputted using G and H keys of the panel-key unit 20 is set).

As above, the number and the type of the storing box and the bill type of bills to be stored therein are set by operating the panel-key unit 20.

Fig. 10 shows a flow of processing of the main controller 111 to control the balance in the bill

handling machine in which the bill storing box 5 can be detached from the machine and can be re-installed therein during its operation.

In step 501, the main controller 111 monitors  
5 the opened or closed state of the door. If the closed state of the door is detected, control goes to step 502. In step 502, the main controller 111 determines whether or not a record "storing box is reinstalled" exists in the main storage 112. If the record is  
10 present, control goes to step 503; otherwise, the processing is terminated.

In step 503, a check is made to determine whether or not the number of bills in the bill storing box re-installed by the operator at resumption of the  
15 operation is inputted. If an attempt is made to resume the operation without inputting the number of bills, control goes to step 504; otherwise, control goes to step 505. In step 504, the main controller 111 sends the condition "the number of bills has not been  
20 inputted" to the higher-level unit 101. The unit 101 displays a warning message to the operator "input the number of bills" to instruct the operator to input the number of bills.

In step 505, the main controller 111 compares  
25 the number of bills inputted by the operator with that counted or calculated as described above. If the comparison results in a large difference, control goes to step 506. If the comparison results in a small

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difference, control goes to step 507. The main controller 111 determines whether or not the comparison result is within a predetermined range in this way. In step 506, the main controller 111 notifies, to the

5 higher-level unit 101, that the number of bills inputted by the operator is excessively larger or smaller than the number of bills in the re-installed bill storing box counted or calculated as above (Figs. 4 and 5). The higher-level unit 101 displays a

10 guidance message to the operator to again input the number of bills. In step 507, the balance of the bills in the storing box under control of the bill handling machine is replaced by the number of bills inputted by the operator. In step 508, the updated balance is sent

15 to the higher-level unit 101.

As above, according to the embodiment, in a case in which after the operation of the bill handling machine is interrupted, when the operator conducts operations such as an operation to additionally fill

20 the bill storing box with bills, an operation to remove bills therefrom, an operation to remove the bill storing box, and/or an operation to re-install the bill storing box in the bill handling machine, the number of remaining bills or the state of the remaining bills in

25 the storing box can be calculated to be reported to the higher-level unit such that the state of the remaining bills in the box is displayed to the operator before the operation of the bill handling machine is resumed.

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Therefore, the operator can confirm the amount of bills remaining in the bill restoring box just re-installed. This also prevents an erroneous operation of the bill handling machine, and hence the transactions can be  
5 continuously processed without any system down of the bill handling machine.

When the operator installs a storing box of another type or another type of bills in the bill handling machine, it is possible before the operation  
10 is resumed that the configuration of the storing box can be again recognized and is reported to the higher-level unit to display the configuration of the storing box. Therefore, the operator can confirm the type of the storing box removed and re-installed, and hence a  
15 wrong operation of the bill handling machine can be prevented. The transactions can be continuously processed without causing a system down in the bill handling machine.

Additionally, the bill handling machine can  
20 cope with various different types of storing boxes and various types of bills, and hence can be directly handle various bills of foreign currencies.

By adopting a panel-key unit which is used when the bill handling machine is operated as a single  
25 unit, information to identify a bill storing box such as type information thereof, e.g., "bill receiving box", "bill paying box", or "recycle box" as well as information of a bill type of the bills stored in the

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bill storing box such as "10000-yen bill", "1000-yen bill", or "US-dollar bill" can be easily stored in the storing box storage.

Furthermore, by using a unit for the operator  
5 to input the number of bills to the bill handling  
machine, the balance can be controlled even when a bill  
storing box is removed therefrom and is re-installed  
therein.

In accordance with the present invention,  
10 there is provided a bill handling machine in which  
information regarding the bill storing box installed  
therein can be collected to be notified to the  
operator.

While the present invention has been described in detail and pictorially in the accompanying drawings, it is not limited to such details since many changes and modifications recognizable to those of ordinary skill in the art may be made to the invention without departing from the spirit and scope thereof.